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(19)

(54) SAFETY DEVICE FOR A TANK OR FLUID CIRCUIT

(71) I, PAUL JOURNEE, of French nationality, of Château de Reilly, 60, Reilly (par Chaumont-en-Vexin) France, do hereby declare the invention for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns a safety device for a tank or fluid circuit which in use may be subjected to an increased or decreased internal pressure, for example a fuel tank such as a motor vehicle fuel tank, or a circuit such as a cooling circuit.

According to the present invention, there is provided a safety device for a tank or circuit for containing fluid, comprising: a base capable of being fitted onto an inlet into the tank or circuit; a chamber carried by the base on the side thereof remote from the side which in use faces into the inlet; at least one aperture through the bottom of the chamber and the base; a cover on the chamber; at least one aperture in the cover; a rod movably disposed in the chamber, with a first end towards the cover and the second end towards the chamber bottom; a first disc fixedly carried on the rod at or adjacent its first end; a second disc fixedly carried on the rod at or adjacent its second end; a third disc which is disposed in the chamber between the first and second discs and at least a part of which is movable in the axial direction of the rod, the diameter of the third disc being larger than the diameter of the second disc and larger than the diameter of the first disc; an aperture in the third disc arranged to be closable by the first disc; a spring disposed around the rod between the second and third discs and operable to urge the second and third discs away from each other, thereby also to urge the first and third discs towards each other for closure of the aperture in the third disc by the first disc; means in the chamber defining a limit position of movement of the third disc towards the cover, whereby when the third disc is in its said limit position the spring bears thereagainst to urge the second disc and thus also the rod towards the chamber bottom; co-operable locating means at the chamber bottom and at the second end of the rod, movement of the rod towards the chamber bottom causing the locating means to come into co-operation to locate the second end of the rod laterally relative to the chamber bottom, the arrangement being such that when in use of the device an increased or reduced internal pressure occurs in said inlet such pressure causes movement of the first and third discs relative to each other to open the aperture in the third disc, thereby to provide a pressure-relieving communication between the interior of the inlet and the exterior by way of the aperture in the cover, the aperture in the third disc and said at least one aperture through the chamber bottom and the base.

Embodiments of a safety device according to the present invention will now be described by way of example with reference to the accompanying drawings, in which:

Figures 1, 2 and 3 show in cross-section, a first embodiment of the safety device, Figure 1 showing the device in a rest position, Figure 2 is the position assumed under the effect of an increased internal pressure in a tank, and Figure 3 in the position assumed under the effect of a reduced pressure;

Figures 4, 5 and 6 show views corresponding respectively to Figures 1 to 3 of a second embodiment;

Figures 7, 8 and 9 show views corresponding respectively to Figures 1 to 3 of a third embodiment; and

Figures 10, 11 and 12 show views corresponding respectively to Figures 1 to 3 of a fourth embodiment.

In the following description of the different embodiments, the same reference numerals denote the same or equivalent components.

Referring firstly to Figures 1 to 3, the safety device comprises a fixing base 1 of

round cross-section, the diameter and shape of which will depend on the size and configuration of the inlet (not shown) of the tank or circuit on which the device is to be fitted. The device may be fitted on the tank or circuit by any suitable means, e.g. by screwing, latching or bolting. In this embodiment, the base 1 forms a unit with walls defining a chamber or recess 2 provided with a cover 3 which is fixed on the chamber 2 by any suitable fixing means. In the illustrated case, the fixing means comprises a bayonet-fitting device partially and diagrammatically represented in 4. The bottom 5 of the chamber 2 is provided with ports 6 and in its centre has a raised hemispherical seat 7. Disposed in the chamber 2 is a rod 8 whose lower end, as viewed in Figures 1 to 3, has a hemispherical recess 9 intended to accommodate the seat 7, so that when the rod 8 rests on the bottom 5 of the chamber 2 the lower end of the rod 8 is located by the co-operation of seat 7 and recess 9.

Adjacent its lower end the rod 8 carries a centrally apertured disc 10 supported on a ring 11 that is fitted into a circumferential groove provided for this purpose in the lower part of the rod 8.

The upper end of the rod 8 is provided with a disc 12, while a further centrally apertured disc 13 is carried on the rod 8, just below the disc 12. The disc 13 is generally perpendicular to the axial direction of the rod 8, and the diameter of the disc 13 is larger than the diameter of the lower disc 10 and also than the diameter of the disc 12. Disposed between the two discs 10 and 13, around the rod 8, is a helical compression spring 14, which therefore urges the two discs 10 and 13 away from each other.

In its central part, around the central aperture or bore 19 through which the rod 8 extends, the disc 13 comprises a sealing ring 15 providing for sealing contact between the disc 13 and the disc 12 of the rod 8.

At its periphery, the disc 13 presents a shoulder 16 defining part of a peripheral recess in which an annular seal 17 is fitted.

Cover 3 presents, in this embodiment, a central aperture 18 aligned with the rod 8.

Operation of this safety device is as follows: in the rest position as shown in Figure 1. the helical spring 14 which bears against the discs 10 and 13, applies the rod 8 against its seat 7 and, simultaneously applies the disc 13 both against the disc 12 by way of the sealing ring 15 and against the cover 3 by way of the annular seal 17. The disc 13 is thus in a limit position of abutment against a surface within the chamber (in this case, the cover 3). In the above-described position of the device, the tank or circuit (not shown) on which the safety device is fitted is closed by the device, i.e. the device provides no connection between the interior of the tank or circuit and the exterior.

Should an increased pressure occur in the tank or in the inlet, the pressure forces act on the rod 8 with discs 10 and 12 to displace it axially upwardly thereby proportionally compressing the helical spring 14. This is the Figure 2 position. As the rod 8 moves axially upwardly, and the disc 12 moves away from the upper disc 13, the pressure within the tank or circuit can escape between the rod 8 and the edge of the bore 19 in the disc 13, as the diameter of the bore 19 is slightly larger than the outer diameter of the corresponding part of the rod 8. The pressure than escapes through the aperture 18 in the cover 3, thereby lowering the internal pressure of the tank or circuit. When this pressure has returned to a predetermined value, the safety device returns to its rest position as in Figure 1.

If, on the contrary, for any reason, pressure in the tank or circuit or the inlet falls below a predetermined limit relative to the external pressure, the latter causes a thrust force to be exerted on the disc 13, which is thereby moved away from the disc 12, since the disc 12 is held stationary relative to the chamber 2 by virtue of the recess 9 bearing against the seat 7. The movements of the disc 13, as in Figure 3, compress the spring 14 which will consequently apply the rod 8 even more firmly against its seat 7. Air can thus flow into the tank or circuit, through the aperture 18, bore 19 and ports 5, to allow the internal pressure to return to its predetermined value. Thereupon the spring 14 will close the disc 13 against the disc 12 as in Figure 1.

As the diameter of the disc 13 is proportionally larger than the bearing or contact diameter of the disc 12 on the seal 15, the safety device will come into operation at a relatively low value of depression in the tank or circuit; in other words, the bearing or contact area when operating under reduced internal pressure is determined by the bearing or contact diameter of the disc 13 on the annular seal 17, and this diameter is proportional to the calibration of the spring 14 for a chosen value of reduced internal pressure, whereas the bearing area for operation under increased internal pressure corresponds to the bearing diameter of the disc 12 on the seal 15. In consequence, owing to the difference in the bearing or contact diameters at the seals 17 and 15, the safety device has a greater sensitivity to reduced internal pressure than to increased internal pressure.

In Figures 4 to 6, the disc 13 has been replaced by a frustoconical disc member 20, the operatively adjacent parts of the device being shaped in relation to the frustoconical configuration of the disc 20.

In Figures 7 to 9, the disc 13 is so shaped as to present a radially inwardly facing shoulder 21 for accommodating a sealing ring 22 to co-operate with the disc 12 and a radially outwardly facing shoulder 23 for accommodating a shaped sealing ring 24. In this embodiment, the disc 10 presents an upstanding peripheral edge portion 25 to guide and locate the lower end of the helical spring 14.

Lastly, in Figures 10 to 12 the disc 26 is fixed by its peripheral edge 27 to the wall of the chamber 2 or to the cover 3 or is shown between the cover 3 and the upper edge of the wall 28 of the chamber 2. This disc 26, which operatively replaces the disc 13 of the above embodiments, is made of a resiliently flexible material, and the part of the disc 26 which extends across the chamber 2 is supported or backed by an annular substantially rigid disc 29 against which the helical spring 14 bears.

In this embodiment, the disc 12 is provided with a circumferential flange 30 directed towards the disc 26 so as to improve the sealing action of the safety device, when in its rest position of Figure 10.

WHAT I CLAIM IS:—

1. A safety device for a tank or circuit for containing fluid, comprising: a base capable of being fitted onto an inlet into the tank or circuit; a chamber carried by the base on the side thereof remote from the side which in use faces into the inlet; at least one aperture through the bottom of the chamber and the base; a cover on the chamber; at least one aperture in the cover; a rod movably disposed in the chamber, with a first end towards the cover and the second end towards the chamber bottom; a first disc fixedly carried on the rod at or adjacent its first end; a second disc fixedly carried on the rod at or adjacent its second end; a third disc which is disposed in the chamber between the first and second discs and at least a part of which is movable in the axial direction of the rod, the diameter of the third disc being larger than the diameter of the second disc and larger than the diameter of the first disc; an aperture in the third disc arranged to be closable by the first disc; a spring disposed around the rod between the second and third discs and operable to urge the second and third discs away from each other, thereby also to urge the first and third discs towards each other for closure of the aperture in the third disc by the first disc; means in the chamber defining a limit position of movement of the third disc towards the cover, whereby when the third disc is in its said limit position the spring bears thereagainst to urge the second disc and thus also the rod towards the chamber bottom; co-operable locating means at the chamber bottom and at the second end of the rod, movement of the rod towards the chamber bottom causing the locating means to come into co-operation to locate the second end of the rod laterally relative to the chamber bottom, the arrangement being such that when in use of the device an increased or reduced internal pressure occurs in said inlet such pressure causes movement of the first and third discs relative to each other to open the aperture in the third disc, thereby to provide a pressure-relieving communication between the interior of the inlet and the exterior by way of the aperture in the cover, the aperture in the third disc and said at least one aperture through the chamber bottom and the base.

2. A safety device according to claim 1 wherein said locating means comprises a recess in said second end of the rod and a raised seat on the chamber bottom.

3. A safety device according to claim 1 or claim 2 wherein the third disc has at its peripheral edge and at the edge of its said aperture respectively sealing means co-operable with an internal surface of the chamber and with the first disc.

4. A safety device according to claim 1, claim 2 or claim 3 wherein the third disc is generally perpendicular to the rod.

5. A safety device according to claim 1, claim 2 or claim 3 wherein the third disc is of a frusto-conical configuration.

6. A safety device according to claim 3 or claim 4 wherein said third disc has a radially inwardly facing shoulder locating the sealing means co-operable with the first disc, and a radially outwardly facing shoulder locating the sealing means co-operable with said internal surface of the chamber.

7. A safety device according to claim 1 or claim 2 wherein said third disc comprises a resiliently deflectable disc portion having its peripheral edge secured to the peripheral wall of the chamber or to the cover, and a substantially rigid disc portion in contact with the surface of the resiliently deflectable disc portion which is towards said spring, whereby the adjacent end of the spring bears against the substantially rigid disc portion.

7. A safety device for a tank or circuit for containing fluid, substantially as hereinbefore described with reference to Figures 1 to 3, or Figures 4 to 6, or Figures 7 to 9, or Figures 10 to 12, of the accompanying drawings.

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1418269 COMPLETE SPECIFICATION

2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

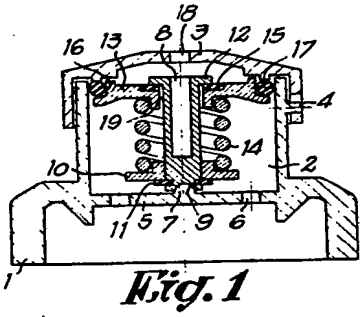

Fig. 1

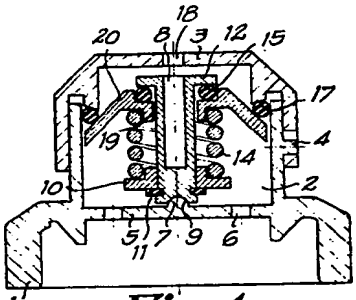

Fig. 4

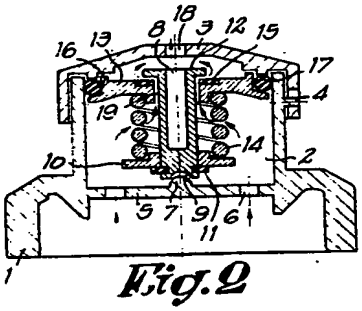

Fig. 2

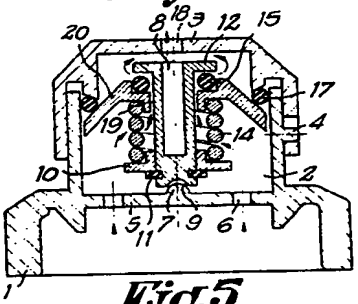

Fig. 5

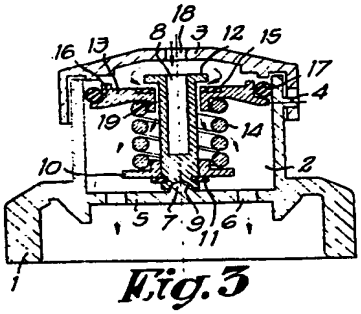

Fig. 3

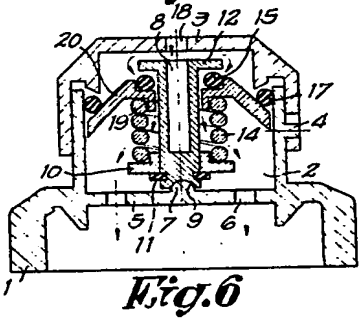

Fig. 6

1418269 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
Sheet 2

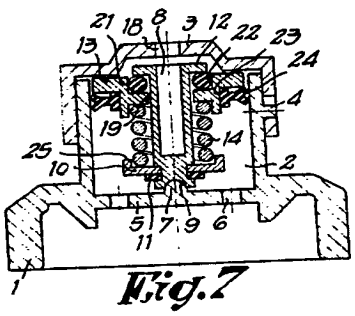

Fig. 7

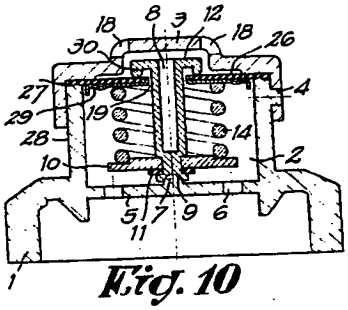

Fig. 10

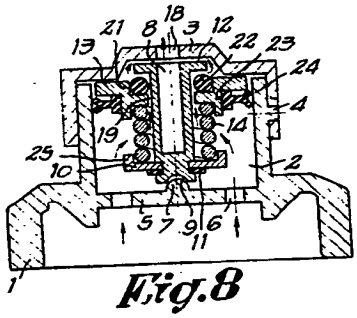

Fig. 8

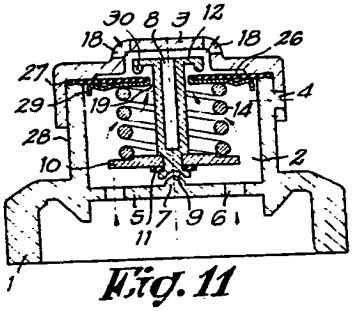

Fig. 11

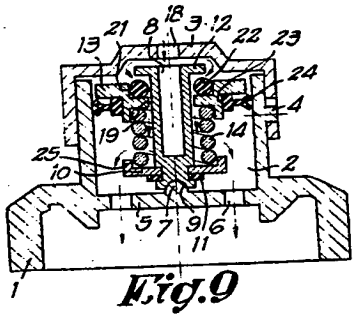

Fig. 9

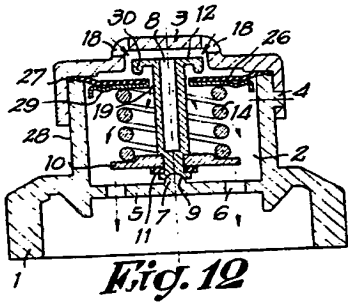

Fig. 12